

Silver Lake Dam Dead River Project No. 10855

May 14, 2003 Fuse Plug Activation

On May 14, 2003 the fuse plug in the Silver Lake project was activated. The fuse plug at the Silver Lake project is an embankment section that is designed and constructed to breach under flood flows to prevent damage to the main dam and appurtenant structures.

A. Description of the Incident

Late in the afternoon on Wednesday, May 14, 2003, high and turbid flows were observed in the Dead River several miles downstream of the remote Silver Lake Basin in Marquette County, Michigan. An operator was dispatched to the site and found that a fuse plug embankment, a feature of the project that is designed to fail sacrificially to prevent failure of more critical project works, had activated. The fuse plug embankment was entirely eroded away and erosion had progressed well into the discharge channel bottom and side slopes. The dam owner activated the emergency action plan and steps to protect downstream lives and property were initiated. During the subsequent 24-hour period, over 1700 residents were evacuated, several local road bridges and an abandoned railroad bridge were damaged or washed out, the City of Marquette's Tourist Park dam near the mouth of the Dead River was overtopped and failed, the Presque Isle coal-fired power plant was shut down due to flooding, and two mines that rely on electric power from the power plant were shut down. There was extensive erosion of the river banks and significant impacts to the Dead River fishery. No loss of life or personal injuries occurred.

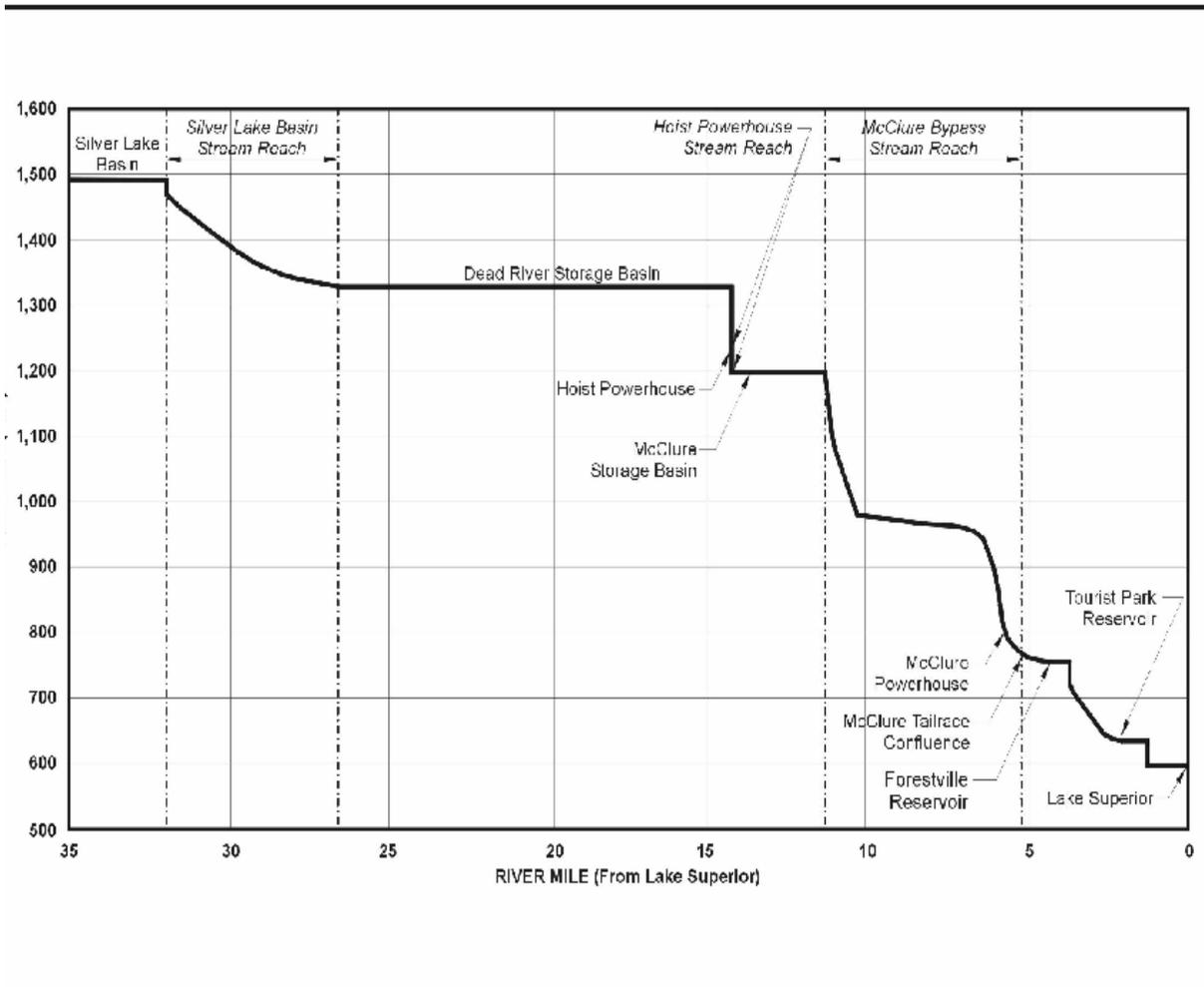
B. Project Description

General Description of the Dead River Basin and Project Area¹

The Dead River drainage flows through the north-central portion of Michigan's Upper Peninsula. It is the largest tributary to Lake Superior in Marquette County. The Dead River flows in a southeasterly direction from its headwaters in western Marquette County. Approximately 20 of the 35 miles of the main stem river are occupied by five impoundments created by the two licensed projects. The three upper reservoirs are in the Dead River Project No. 10855, followed by the two lower reservoirs of the Marquette Project No. 2589

Silver Lake is the first and most upstream dam of the Dead River Project. It is a storage lake with no generating facilities. After approximately 5.4 miles of river, flows enter the Dead River Storage Basin which is impounded by **Hoist dam**. Hydro generation is associated with this development. There are approximately 0.4 miles of free flowing river, including the tailrace, between the Hoist powerhouse and the **McClure** reservoir. The McClure development consists of a very long steel pipeline or penstock carrying flow to the powerhouse where power is generated. The length of the bypassed reach between the dam and where flows reenter the Dead River below the powerhouse is approximately 6.1 miles.

Flows that leave the McClure tailrace and bypass reach almost immediately enter the **Forestville** reservoir which is part of the Marquette Project. The Forestville development consists of a short penstock that bypasses about one mile of the Dead River. The Forestville tailrace discharges into the backwaters of Marquette Project's second development, **Tourist Park**. From here, the Tourist Park powerhouse discharges directly into the Dead River approximately one mile from the mouth of the river at Lake Superior. Figure 1.0 depicts the lengths of the river reaches and the difference in elevations between the developments.



(SOURCE: UPPCO, 1994 as modified by staff)

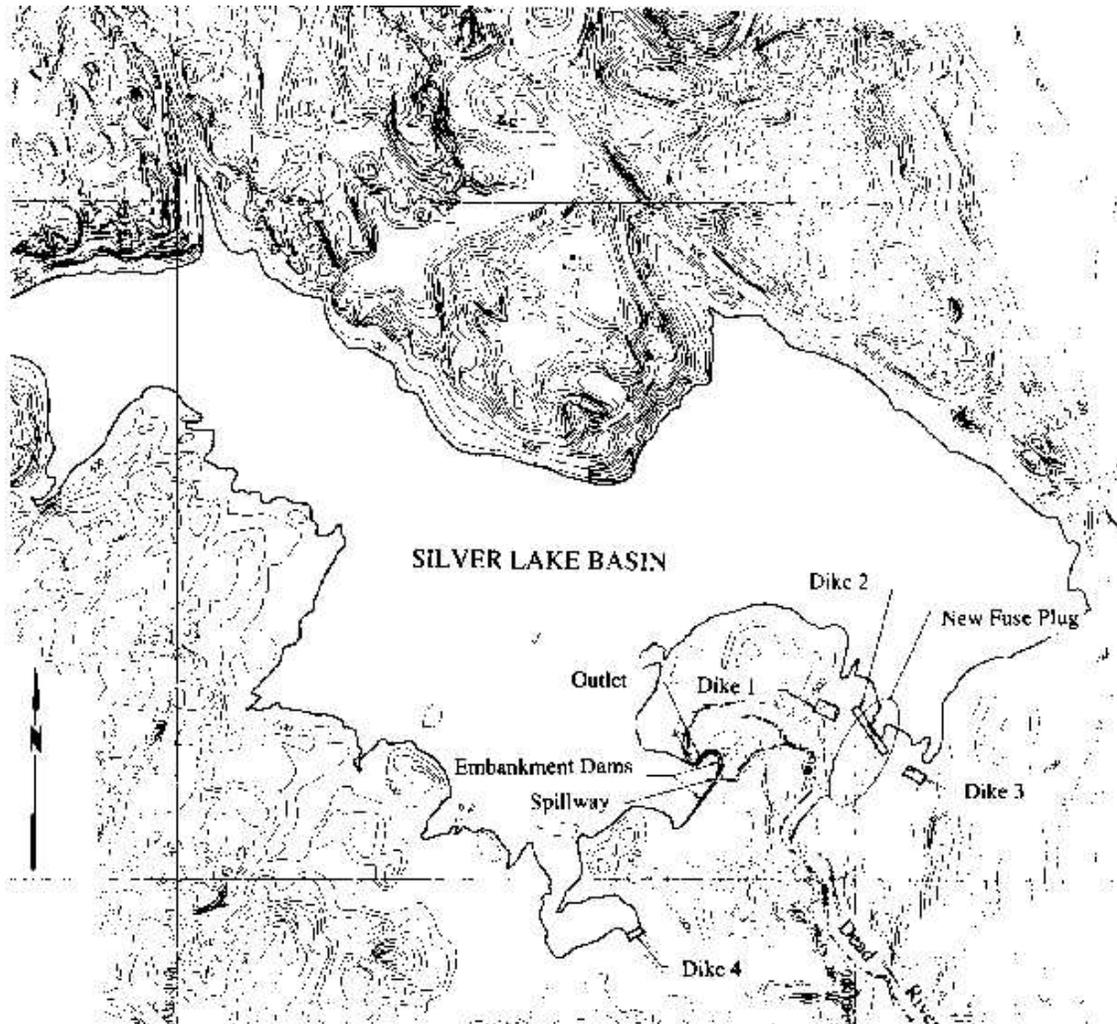
Figure 1.0.
Dead River profile

Silver Lake

Silver Lake Basin is a natural body of water near the headwaters of the Dead River. A

dam was built there in 1896 to increase the storage capability of the basin and augment summer flows in the river. The dam was rebuilt in 1911-12, and again in its present form in 1943-44, when the dam was raised eight feet. The present dam was constructed by Cliffs Power and Light Company, a subsidiary of Cleveland Cliffs Iron Company. It was purchased in 1988, together with the downstream Hoist and McClure projects, by Upper Peninsula Power Company (UPPCO), which is now a subsidiary of Wisconsin Public Service Company. There are no power generation facilities at Silver Lake. The lake is used to store snow melt and spring runoff to augment downstream flows later in the year. The lake is normally drawn down in late fall and winter. Refilling typically begins in March.

Main project structures include the main earthen dam with a concrete spillway (shown below), and four remote dikes constructed in saddles or low spots along the reservoir rim. As noted above, no power is generated at this location.



PLAN VIEW

Figure 2



Photograph 1 – Silver Lake dam and spillway (September 12, 2001).



Photograph 2 - Dike No. 2 before construction of the fuse plug (September 12, 2001)

In the fall of 2002, Dike No. 2 was removed and a fuse plug was constructed in the general area. A fuse plug is an engineered earthen section that is designed to fail sacrificially in order to prevent a more catastrophic failure of the main dam. This action was taken because the project spillway did not have sufficient capacity to pass any more than 20 percent of the required design flood. The design

flood in this case is the Probable Maximum Flood (PMF).

Note that water levels were lowered in the reservoir to complete construction. The fuse plug is about 8 feet high and just over 250 feet long.

Photograph 3 Dike 2 after construction of the fuse plug. (October 8, 2002)

B. Post Event Recovery



Photograph x. Silver Lake channel entrance as viewed from the right abutment. (June 3, 2003).

FERC

- The Division of Dam Safety and Inspections of the FERC mobilized engineering staff to the site by May 15, 2003.
- By the end of the following week (May 23, 2003) a team of engineering specialists within the FERC system had been identified and assigned to the internal review team to investigate the incident.
- FERC contracted with three independent consultants to form the Silver Lake Independent Board of Review (IBOR), to provide an independent evaluation of the incident.
- Both the FERC Team and the IBOR have made an in depth site inspections.

LICENSEE

- Almost immediately the licensee took action to limit access to the site in order to protect the public and to allow operations staff to perform necessary monitoring of the dam structures.
- As water levels receded, it became apparent that some of the river bank areas had been undercut and were unstable. Authorization was given to

take all necessary action to stabilize the banks immediately if there was risk to the public or plant staff.

- Formal plans, specifications and a quality control and inspection plan (QCIP) were developed for the remainder of these activities. Critical attention was paid to arrest further sediment deposition into the streambed.



Photographs , and . Ongoing restoration activities.

Emergency Action Plans work!

The FERC requires all jurisdictional dam owners to develop Emergency Action Plans (EAP) for all projects where a failure could cause loss of life or extensive property damage irregardless of the condition of the structures. These documents establish which areas need to be evacuated, chains of communication and time frames and conditions under which they need to be activated. With the activation

of the Silver Lake fuse plug, the Emergency Action Plans for all of the dams along the Dead River were activated. Appropriate and timely evacuations took place and as a result, there were no deaths, injuries or lost individuals.